MULTIPLE USES OF WATER AND HUMAN HEALTH

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Keywords: Arsenic, Conjunctive use, Diarrhea, Domestic water supply, Fluoride, Groundwater, Health, Irrigation, Multiple use, Wastewater use

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Summary

Increasing scarcity of fresh water resources has made it necessary for the largest user of water, agriculture, to work more closely together with the most valuable user, the drinking water supply sector. The common approach in agriculture to make agricultural water use more efficient by lining of irrigation canals and promoting less water demanding crops, can have unexpected negative impacts on availability of water for domestic use. On the other hand, the conventional approach in the drinking water supply sector to utilize biologically safe groundwater resources is increasingly faced with serious limitations. Problems with groundwater include pollution with arsenic, fluoride, and other chemicals, and reduced availability of shallow groundwater because of over pumping for agricultural use. New approaches include the conjunctive use of surface and groundwater resources for drinking in an integrated manner and recognizing the non-agricultural or multiple uses of irrigation water. The development of improved techniques and policies for recycling of domestic wastewater for agricultural use is another field where the irrigation and drinking water / sanitation sectors have to work together so that water resources management improves livelihoods and protects the health of poor people in developing countries.

1. Water for People, Food, and the Environment: a Common Resource

One of the most critical issues to be tackled in the early 21st Century is the increasing competition for limited fresh water resources between domestic use, agriculture, industry, and nature. In the face of this increasing competition, the traditional sectoral approach to development and management of water resources for all uses independently

is failing. There are widely diverging – and mutually exclusive – views on the desirable path to achieve water security especially within the agriculture and environment communities. Given that irrigated agriculture is the dominant user of water withdrawn from nature for human purposes, the future expansion or contraction of irrigated agriculture is at the heart of the debate. At stake are the size and nature of investments that are necessary to grow food for a growing population, provide sustainable livelihoods for the rural poor and maintain the quality and integrity of the environment.

On average, over 85 percent of the total water supply in developing countries is diverted to the agriculture sector. The agriculture sector of the South Asian region receives about 96 percent of the total diversions. Even in Sub Saharan Africa with a much less developed irrigation infrastructure than Asia, 84 percents of total water diversions is used in agriculture. The difference between credible high and low estimates of the water globally required for agriculture in 2025 is in the order of 600 cubic kilometers – more than is estimated to be required for all domestic uses.

The crisis and conflict is therefore not one of domestic supply versus agriculture. Only a very small fraction of a country's total fresh water consumption is used for domestic purposes and drinking water supply is generally accepted by all as the first priority in integrated water resources development and management. While at the macro level there seems to be no real "competition" between water for domestic use and other uses, there certainly can be sharp conflicts locally, for example between agriculture and cities. The small amounts of water needed for high-value domestic water uses would suggest that a small diversion from the irrigation sector could easily fulfill the demands of a growing population for domestic water. However, reallocation of water between sectors can be difficult, and a truly integrated water-management approach is still constrained by traditional sectoral thinking and by priorities set by professionals in various disciplines. Furthermore, domestic water supply can depend very much on irrigation water management and attempts to save water in agriculture can have counterintuitive, negative impacts on availability of water for domestic use.

This paper argues that there are serious limitations to the conventional sectoral approaches in the drinking water supply and irrigation sectors and that in order to safeguard the health of poor populations in developing countries, all the uses and users of water have to be taken into account in a common water resources policy. The starting point in water resources development should be the actual uses and users of water. This puts the people, the multiple users of water at the fore while appreciating that people operate in a certain physical and institutional environment.

2. Human Health: a Cross Cutting Issue in Water Resources Development

A range of water issues essentially determines the health status of communities, and human health therefore cuts across the three major sectors in water resources development and management:

- In water for people, the focus is on the lack of sufficient supplies of safe drinking water and the transmission of diarrheal diseases and other gastro-intestinal infections;
- In water for food security, the focus is on the hydrological changes caused by dams and irrigation development, and the consequences for transmission risks of vector-borne

diseases such as malaria, schistosomiasis and Japanese encephalitis. The impact of irrigation on the nutritional status of communities varies: on the whole it will be positive but there may be vulnerable groups whose nutritional status declines. On the positive side, irrigation development may result in significant improvements of the economic status of communities, allowing better access to health services.

- In water for the environment, the evidence base for associations between natural ecologies, nature conservation and human health still requires substantial development. It is clear, however, that much of the "environmental services", provided for example by wetlands, are important to sustain the health of communities depending on these ecosystems. Ecosystem health in river basins often equals community health. In specific settings such as wetlands, however, there may be health risks ranging from water associated vector-borne diseases, to sanitation related diseases, to difficult access to health services. It is clear that health will be a key motivator in mobilizing communities to participate in nature conservation and environmental management.

The crosscutting nature of human health through all water issues make health parameters the ultimate indicators of the success of water resources development. During and after water resources development both negative and positive health effects can occur. An example is the irrigation development in the Thar Desert, Rajasthan, India. There used to be no malaria problem in Rajasthan but after irrigation development the number of malaria cases in the Thar Desert went up from a few thousand to 300 000 a year. On the other hand, the canal system of the Indira Ghandi Project (IGNP) has made large quantities of water available for domestic use. It might be regretted that the very ingenious traditional water supply systems of desert villages, consisting of small earthen underground reservoirs are abandoned as soon as canal irrigation water becomes available but it is likely that the increased quantities of water that are available for domestic use provide important health benefits.

3. Limitations to Conventional Approaches in the Domestic Water Supply Sector

There are many water-associated health problems, but the most important of these in terms of number of disease cases and deaths is diarrhea, accounting for two million deaths per year, especially among children. The widespread provision of drinking water that is free from disease-causing microorganisms has long been the main strategy to prevent diarrheal disease. Piped water supply systems that provide treated water are prohibitively expensive for rural communities in many developing countries and technologies have therefore been developed that can provide at least basic facilities to low income communities. In most of the developing world fresh groundwater is now extracted by individual families using hand pumps, or by means of small power pumps serving larger communities. Similarly, sanitation technologies were developed that are appropriate for the socioeconomic reality of developing country communities. While important progress was made during the 1980s, which was declared the International Drinking Water Supply and Sanitation Decade by the United Nations, in 2002 still more than a billion people were without an acceptable supply of drinking water and 2.6 billion lacked adequate sanitation.

There is a general belief within the water and sanitation sector that appropriate technologies are available and that it is now mainly the institutional problems and the

inadequate investments in drinking water and sanitation infrastructure that hamper further progress. However, there are serious limitations to the traditional emphasis on biological contamination and the strategy to exploit bacteriologically safe groundwater sources for drinking water supply.

While much emphasis has been placed on securing a bacteriologically safe drinking water supply, other types of contamination from naturally occurring chemicals in groundwater are newly emerging problems in developing countries. The best documented is the problem of arsenic in groundwater in Bangladesh. But there are also problems with fluoride, salt, and other chemical parameters.

In some regions, the availability of groundwater for drinking is an increasing problem because of overexploitation for agricultural purposes. The extraction of water for irrigation causes the shallow drinking-water wells of poor communities to run dry especially in the dry season. Too little is known about how pumping groundwater for irrigation might affect the levels of arsenic and fluoride in drinking water. However, over-pumping in coastal areas causes saltwater to invade freshwater aquifers, making the water unsuitable for drinking.

The options for improvement in areas where the use of groundwater is problematic because of quality concerns or reduced availability have received little attention. What has become clear is that despite sharing the same resource base, a significant divide still exists between the water supply and sanitation and irrigation sub-sectors. Each sub-sector has developed specialized tools and approaches to water management, which have many parallels, but also remain largely mutually exclusive. The reality of diminishing water resources and the growing acceptance of water as an economic good has brought the two worlds closer together. The gaps, duplications and discontinuities need to be addressed in a common framework in order to face the water management challenge of the 21st Century.

4. Domestic Use of Irrigation Water

In many areas the most readily available surface water is from irrigation canals and reservoirs. It has not been sufficiently recognized that apart from irrigating main crops, irrigation water is used for many other purposes, including domestic uses, home gardens, trees and other permanent vegetation, livestock rearing, aquaculture, wildlife, and small-scale industries such as brick making. Washing clothes and bathing are probably the most frequently observed domestic uses of irrigation systems throughout the world. When there is a poor supply of domestic water from underground mines, but abundant water for irrigation, irrigation water from canals and reservoirs can be the only source of drinking water. In a few cases the domestic uses of irrigation water have been considered in the design of irrigation systems, but more often irrigation system designers have tended to focus exclusively on water use in crop production. On the other hand, providers of domestic water rarely consider the usage of irrigation water as an option because the conventional strategy has been to utilize groundwater, not surface water for domestic purposes.

As a result the non-agricultural household uses of irrigation water have neither been systematically documented nor the possibilities offered seriously explored. A large gap, therefore, remains between what happens in irrigation schemes (what people do) and what is taken into account in water resource planning and policies. With increasing focus on improved water use efficiency within irrigation systems, there is a risk that recognized uses of water--irrigating the main crop--will be prioritized to the detriment of other valuable but non-recognized uses, such as domestic needs. There is a critical need, therefore, to understand the multiple uses of irrigation water, the determinants of use, and the consequences of these uses of water in order to promote informed water resources development policies.

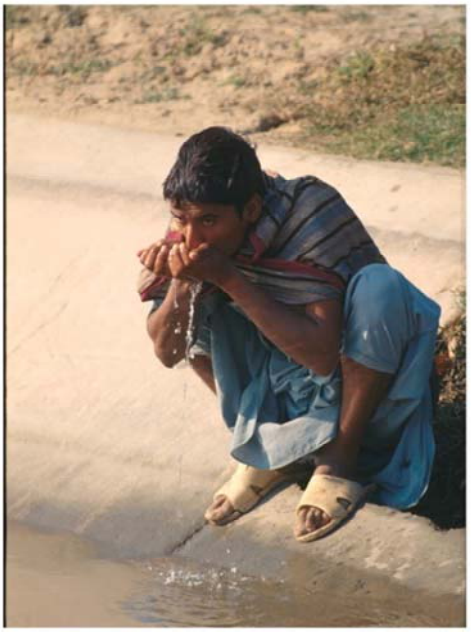

Figure 1. Water from irrigation canals is used for drinking in Pakistan.

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Biographical Sketch

Wim van der Hoek is a medical doctor and epidemiologist who has worked for more than 10 years in several countries in Africa and Asia on public health projects. From 1997 to 2001 he was Research Leader of the Health & Environment Program of the International Water Management Institute (IWMI) based in Colombo, Sri Lanka. His main interest is the epidemiology of water related infectious diseases. Currently he is a consultant based in the Netherlands and an external lecturer at the Department of International Health, University of Copenhagen.